APPARATUS AND METHOD FOR FORMING A DOUBLE GLUED CORNER TRAY STRUCTURE

Cross Reference To Related Applications

This application incorporates by reference and claims priority to application Serial Number 60/429,319 filed November 26, 2002 for "Tray Forming Apparatus And Method Of Forming A Double Glued Corner Tray Structure".

Field of the Invention

[0001] The present invention generally relates to container fabrication systems, and in particular to a container forming apparatus and automated method of forming a container having a reinforced corner construction from a scored blank.

Background of the Invention

[0002] It is well known in the art to use paperboard trays for stacking during delivery to a final destination such as a grocery store and for displaying products such as citrus within the tray as describe in U.S. Patent No. 5,971,906 for a Tray Forming Apparatus and Method. Such trays are typically formed from a single blank which has been suitably cut, scored and perforated to be folded into a completed tray or container for subsequent filling of product and shipping. There remains a demand in the industry to strengthen the tray to overcome damage during stacking and delivery when carrying product, to reduce the time necessary to fabricate the tray, and as a result the associated costs.

[0003] By way of example, in an effort to strengthen such trays formed from a blank, a reinforced corner construction has been developed and is described in U.S. Patent Nos. 5, 853,120 and 5,979,746 to McLoud et al. which describe a container tray having corner reinforcing structures formed from a flat blank. While it is understood that reinforcing corners using multiple flaps or folds within the blank is desirable, it is also time consuming to fabricate such a structure. There remains a need to automatically form containers from flat blanks.

Summary of th Inv ntion

[0004] The present invention is directed to an apparatus and method for forming a blank into a tray having a reinforced corner construction. One embodiment of the apparatus may include a platen dimensioned for biasing against a blank and a platen drive for moving the platen between a first position proximate and in spaced relation to the blank and a second position through a biasing of the platen against the blank and a driving the blank downstream. A forming rail may be positioned downstream the first position for receiving the blank moving thereby and folding portions of the blank with a proximal portion of the forming rail partially folding peripheral portions of the blank and a distal portion of the forming rail securing the blank into a partially formed tray. A first folding arm is movably positioned for biasing against an extended portion of the partially formed tray. A compression plate is movably carried in spaced relation to the partially formed tray and a fixed plate may be carried in spaced relation to the compression plate so as to form a passage. A second folding arm is movably positioned for biasing against the extended portion of the partially formed tray and for folding the extended portion through the passage, with the first and second folding arms and the compression plate biased against the fully folded tray to cause an adhesion of corner portions of the tray and thus a fully formed tray having a double glued side wall construction.

[0005]A method aspect of the invention may include providing a blank having portions thereof for forming a bottom panel, first and second opposing end panels, first and second opposing side panels, wherein each of the opposing end panels has an inside corner support member attached to opposing edges of each of the opposing end panels, each of the opposing side panels having a top wall portion attached thereto, and wherein an outside corner support member is attached to the top wall portion, the outside corner support member having an outside corner support and a side fold portion thereof for forming the blank into a tray having a double glued wall construction. The method may include biasing a platen against the bottom panel for moving the blank downstream through a forming rail positioned for folding the end panels and the side panels, wherein each inside corner support member is folded inwardly of the opposing

side panels, further advancing the platen downstream and to a tray forming position, wherein a distal portion of the forming rail secures the blank into a partially formed tray. The partially formed tray may be configured with the end and side panels positioned generally orthogonal to the bottom panel and each of the inside corner support members are folded and in juxtaposition with the side panel portions, and wherein each of the top wall portions and outside corner support members are generally parallel to respective side panels. The platen is retracted from the tray forming position. A first folding arm may be biased against the top wall portion for folding the top wall portion to a position generally parallel to the bottom panel. The side fold portion may be partially folded by contacting a compression plate. A second folding arm may then be biased against each of the end fold portions for folding them into contact with the end wall. The compression plate is then biased against each of the side fold portions for forming a fully formed tray.

[0006] An adhesive may be applied to a surface of the blank along each of the outside corner members and portions of the side panels proximate prior to moving the blank into the forming position. Alternatively, adhesive may be supplied with the blank.

Brief Description of the Drawings and Photographs

[0007] A preferred embodiment of the invention, as well as alternate embodiments are described by way of example with reference to the accompanying drawings and photographs in which:

[0008] FIG. 1 is a partial front left perspective view of one tray forming apparatus in keep with the teachings of the present invention;

[0009] FIG. 2 is a partial side elevation view of the apparatus of FIG. 1;

[0010] FIG. 3 is a partial front right perspective view of the apparatus of FIG. 1;

[0011] FIG. 4 is a partial top perspective view illustrating a partially formed tray positioned for folding elements thereof using associated folding elements of the apparatus of FIG. 1;

[0012] FIG. 5 is a top perspective view of the partially formed tray of FIG. 4;

[0013] FIG. 6 is a partial enlarged front left perspective view of an adhesive application portion of the apparatus of FIG. 1;

[0014] FIG. 7 is a partial plan view of a corner portion of the blank of FIG. 5 illustrating one embodiment of an adhesive applied thereto.

[0015] FIG. 8 is a top front perspective view of a paperboard blank having a plurality of fold lines and cuts for forming the blank into a tray through a plurality of folding operations;

[0016] FIG. 9 is a partial top plan view of one corner portion of the partially formed tray of FIG. 5 illustrating one embodiment of a platen used to move the blank downstream through a portion of the tray forming process;

[0017] FIG. 10 is a partial perspective view illustrating a first folding arm operable on the partially formed tray;

[0018] FIG. 11 is a top perspective view of the partially formed tray resulting from the folding process of FIG. 10;

[0019] FIG. 12 is a partial top perspective view illustrating elements of the apparatus of FIG. 1 securing a fully formed tray therein;

[0020] FIG. 13 is a top perspective view of the partially formed tray resulting from the folding process of FIG. 12;

[0021] FIG. 14 is a partial perspective view illustrating a first folding arm operable on the partially formed tray;

[0022] FIG. 15 is a partial perspective view illustrating a second folding arm operable on the partially formed tray;

[0023] FIG. 16 is a partial end view illustrating an orientation of a compression plate and a first folding arm prior to a folding movement thereby;

[0024] FIG. 17 is a partial perspective view illustrating an orientation of the compression plate, the first folding arm and the second folding arm is a compression orientation for holding corner portions of a fully formed tray;

[0025] FIG. 18 is a top front perspective view of a fully formed tray formed by the apparatus of FIGS. 1-3; and

[0026] FIG. 19 is a partial enlarged top plan view of one corner portion of the fully formed tray of FIG. 18.

Detailed Description of the Preferred Embodiments

[0027] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, the embodiments herein presented are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

[0028] By way of example, and with reference initially to FIGS. 1and 2, one embodiment of the present invention includes a tray forming apparatus **100** for forming a blank **200** into a fully formed tray **202**. The apparatus **100** may further be described to include a platen **102** dimensioned for biasing against the blank **200** using a platen drive **104** operable for moving the platen between a first position **104** proximate and in spaced relation to the blank **200** and a second position **108**, illustrated with reference again to FIG. 2, through an initial movement and biasing of the platen against the blank for driving the blank downstream the first position, as illustrated with reference to FIG. 3. As illustrated with continued reference to FIG. 1, a frame **112** carried the drive **104** as well as other forming elements and operable devices of the apparatus **100** later described in this section.

[0029] With continued reference to FIG. 3, a forming rail is positioned downstream the first position **106** for receiving the blank **200** and folding peripheral portions **204** thereof, wherein a proximal portion **116** of the forming rail partially folds the peripheral portions of the blank and a distal portion **118** of the forming rail secures the blank as a partially formed tray **206**, illustrated with reference to FIGS. 4 and 5, to be further detailed later in this section. With continued reference to FIG. 4, a first folding arm **120** is pivotally carried by the frame **112** and positioned for biasing against an extended portion **208** of the partially formed tray **206** for a folding thereof. A compression plate **122** is pivotally carried by the frame **112** and in a spaced relation to the partially formed tray **206**. A fixed plate **124** is carried in a spaced relation to the compression plate **122** to form a passage **126**, to be further detailed later in this section. A second folding arm **128** is carried by the frame **112** and positioned for pivoting and biasing against the extended

portion **208** of the partially formed tray **206** for folding the extended portion through the passage **126**.

[0030] With reference again to FIG. 1, an in-feed conveyor **130** may be used for conveying the blank **200** to the first position **106**. BY way of example, one embodiment may include the conveyor **130** placing the blank **200** at an angle **132** to vertical, and thus in a non-vertical orientation for permitting gravity to slidably hold the blank against a surface of the conveyor while conveying the blank on a rotating belt **134**. It is to be understood that the apparatus **100** may be operated with the blank entering at a horizontal orientation as well as the angle position herein described.

[0031] With continued reference to FIG. 1, and to FIG. 6, the apparatus 100 herein described, by way of example, may include a hot glue applicator **136** for applying an adhesive **138** to the blank **200**, as illustrated with reference to FIG. 7. In one embodiment, as herein described by way of example, multiple glue heads **140** may adjustably carried by the frame **112** for providing a specific spray pattern at a specific glue head temperature and thus a temperature of the glue for allowing the last surface to be glued to have a soft glue sufficient for making appropriate attachment as the first glued surface during the folding and compressing of the blank to form the tray. A sensor **146** is positioned for sensing a leading and a trailing edge of the blank **200** for providing a signal to a controller **148** for a timely directed allocation activation signal to allow the adhesive **138** to be applied as desired, such as illustrated with reference again to FIG. 7. With reference again to FIG. 6, the glue heads **140** are directed toward a backstop **150** having a roughened surface **152** for receiving any adhesive **138** that may miss hitting the blank **200**. The roughened surface **152** allows any adhesive collected thereon to be easily removed when dry. It will be appreciated by those skilled in the art that alternate adhesive methods may be employed, now having the benefit of the teachings of the present invention. By way of example, stapling may be employed in conjunction with the various folding and biasing steps in forming the tray. Yet further, an adhesive may be carried by the blank that is responsive to temperature or pressure for activation. Similarly, various shaped blanks having various constructions may be used to form a container having a desirable shape, now given the teachings of the present invention.

[0032] To more fully describe aspects of the invention, the paperboard blank **200**, as illustrated further with reference to FIG. 8 is herein described by way of example only. The blank **200** may be described to include a bottom panel **210** with first and second opposing end panels **212** formed at opposing peripheral end portions **214** of the bottom panel via first fold lines **216**. First and second opposing side panels **218** are connected to opposing peripheral side portions **220** of the bottom panel **210** via second fold lines **222**. An inside corner support member **224** is attached to opposing edges **226** of each of the opposing end panels **212** via a third fold line **228**. In an optional construction, herein described by way of example, the inside corner support member **224** includes a fourth fold line **230** for forming a bevel within the tray construction. A top wall portion **232** is attached to opposing edges **234** of each opposing side panel **218** via a fifth fold line **236**. Further for the blank **200** herein described by way of example, an outside corner support member **238** is attached to each of the top wall portions **232** via a sixth fold line, wherein the outside corner support member **238** includes a seventh fold line **242** for providing an outside corner support via an end fold portion **244** and a side fold portion **246**. The above further illustrated with reference again to the single corner portion of FIG. 7.

[0033] Now having described the blank **200** more fully, embodiments of the apparatus **100** may be further described through detailed illustration. By way of example, and with reference again to FIG. 7, the platen **102** may comprise a rectangular peripheral portion dimensioned for folding the rectangular shaped bottom panel **210** of the blank **200** into a rectangular shape. In one embodiment of the blank **200**, above described, the peripheral portion **154** of the platen **102** includes bevelled corners **156**, as illustrated with reference again to FIG. 5, and to FIG. 9 to form the bevel **248** within the inside corner support member **224**. The platen **102** is dimensioned and aligned to fit proximate the first and second fold lines **216, 222** when contacting the bottom panel **210**. It is to be understood that while the inside corner support member is herein described by way of example as having a bevel portion, alternatively it may have a single fold to form a squared inside corner. It will be further understood that while the corner construction herein described in relation to the end panel and the side panel, the

tray may be constructed in a mirror image or with reference to alternative end and side panels forming the tray.

[0034] With continued reference to FIGS. 7 and 9, a guide plate **158** is carried by the platen **102** for further defining the platen peripheral portion **154** and for providing a compression surface **160** operable with the inside corner support member **224**. The compression surface **160**, as herein described by way of example, may comprise depressions for reducing a frictional contacting surface thereof. The corrugations on the compression side of the guide plates reduce the surface area for providing increased pressure on glue points while at the same time reducing friction between the guide plate surface and the tray inside wall to allow the platen to be more easily removed when being retracted, as earlier described.

[0035] By way of further example for the tray **202** herein desired, and with reference again to FIG. 3, the inside corner support member **224** is folded to about 90° while the side panel **218** is folded upward approximately 30°-45°. Next the end panel **212** is folded up approximately 90° and the side panel **218** is brought up to a 90° fold compressing the side panel, having the adhesive **138** thereon, against the inside corner support member **224** having the guide plate **158** against it. As a result, the rectangular structure of this sample tray is formed. Each guide plate **158** may includes adjustment screws for aligning the guide plate and positioning the corrugated surface **160** of the guide plate for a desired attitude when compressing varying styled trays. As a result an adjustable platen is provided

[0036] Again using the blank **200**, by way of example to more fully describe elements of the embodiment herein presented, reference is again made to FIG. 3 wherein the forming rail **114** may include opposing end folding rails **162** positioned for receiving the end panels **212** and dimensioned for upwardly folding them from the bottom panel **210**. Opposing edge rails **164** are positioned for inwardly folding outside edge portions, the inside corner support members **224**, herein described by way of example. Opposing side folding rails **166** are positioned for receiving the side panels **218** of the blank **200** and for folding the side panels upwardly from the bottom panel **210** while capturing the inside corner support members **224** therebetween. As earlier described, the blank **200** is received at proximal portions **116** of the forming rail **114**, and a distal portion **118**

thereof secures the now partially formed tray **206**. The forming rail **114** folds the end panels **212** about the first fold lines **216** and the side panels **218** about the second fold lines **222**, with each inside corner support member **224** folded about the third fold line **228** inwardly of the opposing side panels **218**. The partially formed tray **206** is configured with the end panels **212** and the side panels **218** positioned generally orthogonal to the bottom panel **210** and each of the inside corner support members **224** folded about the third fold line **228** and in juxtaposition with the side panel, as illustrated with reference again to FIGS. 5 and 9. Each of the top wall portions **232** and the outside corner support members **238** are generally parallel to respective side panels **218** thereof.

[0037] With reference again to FIG. 4, a locking arm **168** is operable with the folding rail described with reference to FIG. 3 for securing the partially formed tray **206** at the second position **108**, herein shown separately for clarity.

[0038] With the partially formed tray **206** secured in the second position **108**, as illustrated with reference again to FIG. 4, by way of example, the platen **102** is retracted and the folding of the top wall portions **232** and the outside corner support members **238** commence. With reference again to FIG. 2, and to FIGS. 10 and 11, the first folding arm **120** is operable for folding the top wall portion **232** about the fifth fold line **236** to a position generally parallel to the bottom panel **210**. The side fold portion **246** is partially folded about the sixth fold line **240** by passing through the passage **126** formed by the spaced compressed compression plate **122** and the fixed plate **124**. As earlier described, the compression plates **122** are moveable for biasing against each of the side fold portions **246**. A squared inside corner is illustrated by way of example in FIG. 10, wherein a squared corner platen **103** would be employed.

[0039] For the double-glued corner construction, herein described, the partial folding of the side fold portion **246** has been shown to improve on the performance and speed in the forming process. The fixed plate **124** allows the outside corner support member **238** to stay oriented relative to a plane of the top wall portion **232** resulting in a "squared off" corner construction with vertical walls providing a desired strength needed during stacking of filled trays. By way of example, damage to fruit is avoided especially for the lower trays in the stack. It is to be understood that while the compression plate as

herein described is used for both a guide plate to form the passage and a compression plate during movement thereof, alternatively a separate compression plate may be used in conjunction with a separate passage.

[0040] With reference to FIGS. 12 - 15, a forming of the outside corner support members **238** commences with the second folding arm **128** rotated against the end fold portions **244**, folding them about the sixth fold lines **240**, and biasing the end fold portions against the end panels **212**. As illustrated with reference to FIG. 12, by way of example, an edge **245** of the end fold portion **244** is guided onto the end panel **212** along a surface **125** of the fixed plate **124** for orienting the end fold portion **244** in a preferred orthogonal relation to the bottom panel **210** for enhancing the load bearing strength of the tray **202**, as earlier described. A final compression phase includes the compression plate **122** folding of the partially folded side fold portion **246** and compressing thereof as illustrated with reference to FIGS. 16 -18. Compression forces act upon each corner of the fully formed tray **202** with the compression plate, the first and second folding arms, and the locking arm each providing opposing forces to compress the adhesive against respective tray surfaces, as further illustrated with reference to FIG. 19 including a partial top view of the double glued wall construction. As will be understood by those skilled in the art, the controller **148** earlier described with reference to FIG. 1, a controller is operable with drive devices for each of the platen drive, the compression plate, the first folding arm, the second folding arm, and the locking mechanism for a timely movement thereof. With such, the fully formed tray **202** may be released from the frame **112**. As illustrated with reference again to FIG. 2, a glue-setting phase may be provided as herein described, by way of example, with reference to a magazine styled frame **172** which receives the fully formed tray **202** stops **174**, such as that of the locking arm **168** are released to permit a subsequent tray being formed to push the fully formed and glued tray into the magazine styled frame **172**. The magazine styled frame **172** includes framing elements **176** that form an aperture for receiving the tray having an increased outside dimension as a result of the folded corner construction.

[0041] As illustrated with reference again to FIG. 2, the apparatus **100** herein described by way of example, carries three trays within the apparatus with a first tray in the

forming and compression phase, a second tray being held in the magazine styled frame section for glue setting, and a third tray ready to be ejected when a fourth blank is pushed into position for forming into the partially formed tray.

[0042] Many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is understood that the invention is not to be limited to the specific embodiments disclosed, and that modifications and embodiments are intended to be included within the scope of the claims herein presented.